Entry of low-cost airlines in Germany

Some lessons for the economics of railroads and intermodal competition

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Abstract

We investigate the entry of low-cost airlines (LCAs) in the German passenger transportation market. Using some unique turnover, pricing and market research data we find that substitution rates between LCA and the incumbent rail operator Deutsche Bahn (DB) are substantial. As the competitive pressure of LCAs is surprisingly effective, both air and rail transport networks are forced to reconsider their pricing strategy. We document the price reactions of the two network providers. Lufthansa reacted by a drastic cut of all prices for all intra-German origin and destinations (O&Ds). DB reacted successfully on some O&Ds, by mimicking the price structure of the LCAs. We argue that the physical conditions of railroads provide a rationale for the reaction of DB. As railroads are an open system, changing the price system on one O&Ds has substantial opportunity costs on other O&Ds in the same network. This imposes constraints on price strategies which neither LCA nor the incumbent air network provider have to satisfy to the same extent. While this reduces the capability to react for a rail network provider, reactions can be swift and efficient as we show for some O&Ds. Our case shows the relevance of modern industrial organization and incentive theory in better understanding the interaction of different modes on the same market. It also has some interesting implications for regulation of the European long-haul passenger market.

Keywords: price strategies, incentive constraints, regulation
JEL codes: L11, L92, L93

1. Introduction

Throughout the last few years, low-cost airlines (LCAs) have gained substantial market shares. This trend has initially been confined to the US and the UK, but more recently, LCAs have also entered the continental European markets. While there is some research about the interaction of LCAs and incumbent network airlines,[1] little or nothing is known about inter-modal competition between airlines (both LCAs and network carriers) and train operators.

However, the functioning of *intermodal* competition in the passenger market is an important problem for Europe, for a number of reasons. First, trains hold a large share in the market for long-haul passenger traffic. According to internal data of the *Deutsche Bahn*, the rail market share in long distance connections is 12%. Incumbent rail operators maintain and expand high-speed trains that compete for many of the origin and destinations potentially served by LCAs. (Examples are Cologne – Paris; Paris – London; Hamburg – Munich). There are also a number of large investment projects that aim to open high-speed origins and destinations (O&Ds) that are already or may in the near future be contested by LCAs (for instance in Spain).

Second, the European Commission has, in its White Paper (EC, 2001), declared the development of the rail sector a priority for sustainable development. The European Commission has the explicit goals of promoting railways, increasing their market share, and reducing subsidies. Third, the Commission is committed to enhance *intra-modal* competition in the rail transportation market by liberalizing access to national infrastructures, first for freight traffic, and soon also for passenger traffic.

The issue of developing the rail sector is linked to the question of *inter-modal* competition. This is in particular the case as LCAs seem to be increasingly important. There are yet no data sets available that would allow to derive estimates about the intensity of future competition between LCAs, network airlines and rail operators and about market outcomes. In such a situation, it is useful to investigate case studies in order to learn more about the functioning of what may in the future become an integrated European long-haul transportation market.

The case we look at is LCA entry in Germany. In late 2002, two LCAs opened 16 new routes in the course of only few weeks. Some of these origins and destinations (O&Ds) were (and still are) in direct competition to routes of the *Deutsche Bahn* (DB), the incumbent rail network operator in long-haul passenger traffic. Using some unique turnover, pricing and

[1] See, for instance, Alderighi et al. (2004), Franke (2004).

market research data, we document the impact of LCA entry on *Deutsche Bahn* and the incumbent air network provider, *Lufthansa* (LH). We look at their reactions to entry and argue that the different network constraints air and rail network providers are subject to may explain some of the differences in their reaction strategies.

Our main results can be summarized as follows: First, LCA entry appears to have much stronger effects than what one would expect given the measures of inter-modal price elasticities that exist in the literature. Turnover of *Deutsche Bahn* dropped drastically. Market research shows that air and rail traffic are close substitutes, in particular for trips of up to five hours. Second, the entry of LCAs forced DB to react. Looking at their price reactions on one origin and destination, it turns out that mimicking the price structure of LCAs is a quite effective way to regain competitiveness and to stabilize turnover, albeit on lower levels than before LCA entry. Third, DB only changed prices locally, that is, the overall price system remained unaffected. In contrast, *Lufthansa*, changed its entire price system, and introduced much lower prices for all intra-German O&Ds and many European routes. Fourth, we argue that this type of asymmetric price reaction is owing to different technological constraints of rail *versus* air network operators. In general, transportation is a business with high fixed costs, that is, per-passenger costs are much lower at high load factors. In general, transportation firms have high fixed costs, and their average costs are hence very dependent on load factors. This is particularly true for railroads, which would hence have a strong incentive to engage in aggressive yield management practices on contested O&Ds. However, their network structure makes such strategies very costly: Rail networks have a fundamental disadvantage compared to airlines. They constitute an open system, in which passengers who travel on a train from A to B are free to enter and exit at any place between origin and destination. Hence, reducing the prices on the O&D from A to B, may have severe yield effects on all O&Ds that lie in between the contested line, and on those that include the contested segment. Therefore, while many railways already use yield management, it cannot be employed as effectively as at airlines.

The next section provides some background on the business model of LCAs. In particular, we compare LCA cost structure to network rail operators. Section 3 documents the entry of LCAs in Germany and the effect on DB's traffic. Section 4 describes the reactions of the network operators and some of its effects. It also provides estimates of substitution rates between train and LCA. Section 5 discusses the constraints railroads are subject to when carrying out price reactions. The concluding section summarizes and points to implications of this case study on regulation of intra- and inter-modal transportation markets.

2. Low-cost airlines, network airlines and network rail operators

The first low-cost airline entered the US market in 1971: *Southwest Airlines* began to operate flights between Dallas, Houston and San Antonio. The fleet rapidly expanded, and today Southwest Airlines is the largest domestic operator in the US. It has never operated at a loss, and many companies have tried to emulate its business model. As of today, there are 15 low cost airlines in the US, and estimates of the market share of low cost carriers in the US are estimated over 22% (Mercer Consulting, 2002) and 24% (Ito and Lee, 2003).

Europe's history of low-cost airlines is much shorter. The EU deregulated the airline market only in 1997, and the market share in EU countries differs between high single-digit numbers in, for instance, Germany and France, and 15% in the UK (Eurocontrol, 2003). In late 2002, two LCAs opened 16 new routes in the course of only few weeks. Slide 2 shows that Germany was among the markets with the highest growth in LCA market share. Many observers believe this to be a sign that Germany may enter a similar phase of rapid LCA growth as the UK did in 2001.

The LCA business model enjoys substantial cost advantages compared to incumbent airlines. The estimated advantage in terms of cost per available set mile (CASM) is between 25-30% for domestic flights, and 40 to 60% for border-crossing traffic (Binggeli and Pompeo, 2002). This is owing to higher resource utilization (especially of fleet), but also to lower labor costs (LCAs employ younger non-organized workers), cost-effective direct sales systems, younger and homogenous fleets that imply lower maintenance costs, and lower ground handling costs and landing fees (Franke, 2003).

Slide 3 qualifies the view that LCAs have cost advantages compared to rail network operators. It shows that the costs of LCAs in terms of CASM are *not* lower than the one of the rail network carrier *Deutsche Bahn*. *Deutsche Bahn*'s CASM is comparable to *Ryanair's* and lower than *EasyJet's*. There are strong economies of scale in railroads, in particular, *economies of density*, that is, the marginal costs per passenger mile at given network size decreases in traffic volume.[2] However, Slide 3 also shows that railways in Germany operate at much lower load factors than LCAs. The challenge is therefore to raise load factors significantly. Hence, it appears a good strategy for a rail operator to engage in aggressive pricing practices beyond the normally-used yield management upon entry of an LCA.

[2] For an overview over the literature on the economies of scale in the railroad industry see IDEI (2003). Notice that there is rather inconclusive evidence concerning *economies of size*, that is, the development of costs when, at given density, network size increases.

An additional advantage of LCAs is their flexibility. They can decide to operate on new origins and destinations (O&Ds) without having to invest much in new infrastructure. As they often use the same types of aircraft and there is a high degree of international standardization across airports, the costs of reallocating assets from one O&D to another are low. Direct sales instruments, in particular, the internet, allow for rapid price changes. Moreover, the price of one O&D has little, if any, effects on the price of other O&Ds served as there are no connecting services offered.

3. LCA entry

Slide 4 shows that since the beginning of 2001, the LCA market share in domestic airline transportation in Germany was slowly growing. At the end of 2002, it jumped from around 4% to 8%, when two companies, *HapagLloyd Express* and *Germanwings* started 16 new O&Ds. The LCAs offered intra-German connections at truly competitive prices. On average they charged around 70 Euros one-way, less than 40% of the average price of Lufthansa prior to the LCA entry, which was around 180 Euros.

It is difficult to come up with *a priori* estimates for the effect of LCA entry. The most important piece of information is the inter-modal price elasticity, here, between rail and air. Cross-elasticities are an imperfect measure for entry effects, because formally, they measure the sensitivity of rail traffic, when the price of the inter-modal competitor increases or decreases. But, we here look at the entry of a new business model, which is not a perfect substitute for existing air services. Hence, the estimates of elasticities can only have indicative function. But even so, it turns out that surprisingly little is known about the cross-elasticities between air and rail. In one survey (Oum et al., 1990), estimates are rather small - between 0.01 and 0.51, but this is based on aggregated data and not some well-defined market. According to the Australian Bureau of Transport and Regional Economics data base referred to in IDEI (2003), the elasticities are - besides one potential outlier (1.12) - in the range between 0.04 to 0.36. In general, it is believed that the elasticities between different modes are small in the short term, and potentially substantial in the long run only. Given these estimates, one should expect small effects of LCA entry on the rail network operator's traffic. However, the LCA entry in Germany had a massive impact on rail traffic.

To measure the effects of LCA entry on rail turnover and yield, consider first the magnitude of entry. Slide 5 provides some estimates for the size of business of some O&Ds operated by LCAs compared to the size of DB's business on the same O&Ds. Depending on the O&D, LCAs business is up to 70% of DB's. More striking are the estimates of substitution rates provided by Grunberg et al. (2003) who surveyed a total of 2408 travellers at six German airports that are major LCA gateways: Berlin, Dusseldorf, Hamburg, Hanover, Cologne-Bonn, Moenchengladbach. The researchers asked travellers about their choice if the LCA O&D that they used had not been available: A share of 79% of the respondents would have used a different transport mode, 15% would not have travelled at all, and 6% would have travelled to another destination. Within the first group, 20% would have definitely chosen rail transportation, and a further 13% would have considered rail transportation as an option.

Slide 6 shows the breakdown by some O&Ds. The lower bound is the proportion of customers who would have chosen rail for sure, the upper bound represents customers who would have considered rail as an option. Slide 7 shows the breakdown by hours of rail traffic. There is a strong correlation between rail travel times and substitution rates, on shorter distances LCA substitution is highest. Notice that these numbers imply a price elasticity that is far above the estimates from other studies.

Slide 8 shows the effects on DB's turnover on one domestic line, Hamburg-Cologne. On this O&D, DB operates trains of different quality and speed. The fastest and most comfortable train is the *Metropolitan Express*, a premium product that targets mainly business travellers and that travels non-stop between two of the main commercial and industrial centres in Germany, the Ruhr Valley and Hamburg. *HapagLloyd Express* entered on December 3rd, 2002 on this O&D. As the graph shows, the turnover of DB, measured in passenger kilometres decreased immediately and reached a 30% lower volume after three months. Some international O&Ds of DB suffered similarly, as the second panel on Slide 8 shows. DBs traffic volume from Hamburg to Vienna decreased by more than half. Slide 9 provides another estimate of the effects of LCA on DB's traffic, here on the O&D from Cologne to Berlin, another main axis of passenger rail transportation.

It is difficult to exactly quantify the effect of LCA entry on DB's traffic volumes, as the entry of LCA correlated with other events, in particular, a hard winter that led to problems with punctuality. An additional confounding factor was a new DB pricing system that many customers perceived negatively. It is important to note that these changes were not related to the LCA entry, but had been decided before. Furthermore, the *Metropolitan Express* between Cologne and Hamburg was *not* affected by these price changes as it operates as a separate company within the DB Holding. Nonetheless: taken together, the evidence seems to indicate that rail traffic has been highly sensitive to LCA entry, in particular, for trips of up to five hours. These effects are much stronger than what one could expect given the low estimates of cross-elasticities from previous studies.

4. Reactions

Shortly after LCA entry, *Lufthansa* (LH) reacted by an overhaul of their pricing system. The company introduced a new lead price of 92 Euros for all O&Ds within Germany and some of its European connections (UK, Austria and Switzerland). The price levels of LH are fixed, but the available contingent of seats in any price category can be adjusted to the strategic needs. That is, *Lufthansa* disposes of a flexible yield management that allows the company to react to new entries or price changes by adjusting the quantities of seats in different price categories. While we do not know the precise effects of these changes on turnover and yield for Germany, *Lufthansa's* turnover in Europe during the first six months of 2003 (after LCA entry) compared with the first six months of 2002 decreased by 6.4% and the yield decreased by 11.8%. (*Lufthansa*, 2004)

The reactions of *Deutsche Bahn* differ from the ones of *Lufthansa*: rather than changing its price and seat contingent *system*, *DB* only reacted on some O&Ds. More precisely, DB changed the prices of the *Metropolitan* and of night trains, because they are not priced within the general DB pricing system. Slide 10 compares the price system for the *Metropolitan Express* from Cologne to Hamburg. Prior to LCA entry, the cheapest price was 50 Euros and the most expensive price 79 Euros. Here, the lowest price was "weekend special", requiring Saturday night stay and five-day advance purchase; the next price was "return special", requiring return purchase and three-day advance purchase; the full fare had no restrictions. DB then changed the prices for this train, offering the cheapest ticket at 19 Euros, and four more prices, up to 79 Euros. New prices are all one-way without any restrictions – only quotas regulate availability, exactly like in airline yield management. The second panel of Slide 10 shows that this reaction had massive effects and that the traffic volume reached similar levels than before the entry. However, the yield dropped by 23% when one compares the year before LCA entry with the 9 months after the price reaction. Slide 11 shows that the fare change involved a stabilization of turnover. This implies that there was a substantial drop of the average price on the O&D.

This example shows that, in principle, an incumbent rail operator can react by setting other prices, and that this can stabilize the situation in terms of traffic volume. It, however, also raises the question if such reactions would be feasible for all of the affected O&Ds.

To answer this question it is useful to first look at the network structure of the three main actors, LCAs, Lufthansa and DB. LCAs mainly operate on point-to-point connections. Railroad and airline incumbents operate networks. Slide 12 depicts the polycentric network structure of both Lufthansa and DB. This type of network structure imposes important constraints on the strategies of the incumbents.[3]

First, LCAs can change their schedules at short notice – provided that the airports they want to connect have slots available. A rail network operator cannot change its network in the short-term as this requires massive, expensive and time-consuming infrastructure investments. It is also difficult to change the schedule of traffic, given a physical network of tracks. Adding or taking away a connection, or increasing or decreasing the frequency on one connection potentially affects many other connections. Schedules are usually planned with long lead times and they are the result of complicated optimization procedures. Often, there are a number of bottleneck tracks in a network that impose binding constraints that need to be taken into account for any short-term adjustment. This is to some extent also true for the connections of an air network carrier who when planning any change in schedule must take into account the effects on connecting flights.

Leaving problems of network management aside, it is important to note that the price strategies of railroads are subject to an important set of constraints that do neither exist for LCAs nor for air network carriers. As pointed out before, railroads enjoy cost advantages over most airlines, provided that they can reach sufficiently high load factors. Hence, if an entrant attacks a railroad on a given O&D, the railroad should be expected to reduce its price in order to increase the load factor and reduce average costs per passenger. However, this is not as easy as it seems.

Slide 13 illustrates the problem. Consider the point-to-point connections of LCAs. They represent a closed system: a customer who boards a plane from, say, Paris to Cologne cannot disembark at a place between the two points. This is not true in a rail network: it is very difficult to prevent customers from getting off a train in Brussels given that most if not all trains between Cologne and Paris have a stop in that city. In a closed system, it is possible to use aggressive prices, while in an open system, there is a risk of "cannibalization". When the operator reduces the price on the connection from Paris to Cologne, it must take into account the potential yield effect for the legs from Paris to Brussels and Brussels to Cologne.

Slide 14 illustrates a real-world example. The LCA on the route Cologne-Berlin has a lead price of 19 Euros. The curve represents the 50% discount fare that is available when the customer holds a subscription to BahnCard, which costs 200 € for 2nd class; 400 € for first class per year. This fare is also available in limited quantities for early booking with weekend

[3] It is interesting to note that the case is different for the long-haul network of French railroads, which is monocentric.

restrictions. Consider that DB would reduce its price to Berlin to the same level of the LCA. This would make it attractive to customers on many segments between Cologne and Berlin to buy a ticket to Berlin, rather than to their preferred destination. To be consistent, DB would have to quote the price to Berlin to any customer for whom that ticket would be cheaper than the ticket for the segment they want to travel on.

Railroads are also subject to the problem of "sum of locals" ticketing. Consider a rail customer who travels from A to D. Suppose that there is an LCA entrant in a segment B to C that is part of the A to D connection.[4] The rail operator would like to reduce the price on the B to C connection to stay competitive. However, this would involve yield erosion on the A to D connection: customers could book one ticket from A to B, another from C to D, at the usual prices and a third ticket from B to C at the new, lower price. Network airlines are subject to similar problems, and hence do not allow "sum of locals" ticketing. They can reject passengers who have such tickets or refuse through-checking of baggage. For railways, it is much harder to avoid the problem, as it is both difficult to detect "sum of locals" and - if detected - to send customers off the train. LCAs are not subject to the problem, as they usually do not operate connecting flights.

The heart of the above problem is the presence of customer asymmetric information.[5] When designing its tariff structure, the rail operator must take into account the "incentive compatibility constraints (ICs)"[6] of customers. In our case, the tariff structure satisfies the ICs, if a customer who plans to travel on the intermediate legs (Paris to Brussels, Brussels to Cologne) has no incentive to buy a ticket Paris to Cologne. That is, the price between Paris and Cologne must be larger as the price of any of intermediate O&D's. Otherwise, the railroad operator would lose some of its yield on the intermediate O&Ds. It may be the case that the lost yield on the intermediate O&Ds is more than compensated by gains on the O&D Paris to Cologne, in which case the rail operator may decide to deliberately violate the IC. But, in general, the IC imposes a floor for a price change. This severely constrains the

[4] A realistic example is Aachen (city A) to Rostock (D) with Cologne (B) and Berlin (C).

[5] For the state of the art of incentive theory in regulated markets, see Laffont and Tirole (1992).

[6] In the theory of contracts, the "incentive compatibility constraint" defines a constraint a principal has to take into account when designing optimal contracts for agents that possess private information. In such situations, the principal designs a menu of contracts for each type of agent (here "type" describes the sort of private information an agent has, for instance, whether they have high or low valuation for a good the principal sells), and agents select their preferred contract. One can show that in such a situation it is usually optimal for the principal to make the agent reveal their private information, that is, in equilibrium each agent chooses the contract that has been designed for their type. However, in order to do so, it must be true that the agent cannot lose from accepting the contract designed for their type, that is to reveal their information, rather than pretending to be a different type. This condition describes loosely the incentive compatibility constraint we refer to. The theory of contracts

capability of a network railroad to react to a low-price entrant on a given O&D. As pointed out, an airline network operator is not subject to the same ICs, which gives them more flexibility concerning their price reactions.

In order to relax the IC of customers, the railroad operator may think how to screen customers according to their points of origin and destination. It may decide to check at any train station whether a passenger has travelled between the points they hold a ticket for and, if not, to make them pay the difference (and maybe also a penalty). Another potential system is to sell tickets for any segment on a given O&D at the price of the most expensive segment and to reimburse passengers who prove that they have travelled on less expensive segments. While the first possibility is easier to implement administratively, it may involve resistance of customers. The other solution may be harder to implement, but as it has the nature of a bonus, rather than a penalty, may prove to be more popular.

The discussion above has been based on the notion that customers are fully rational. However, this may not always be the case. In modern transport markets, pricing systems are often very complex; it takes even an experienced traveller some time and effort to learn about the best offers in the market. There is hence a benefit in using aggressive lead prices to communicate with customers and to attract them, although the communicated prices are lower than those that are actually available to most passengers. Nonetheless, customers with significant information gathering costs will be susceptible to this effect. Railways are unable to match these lead prices owing to the pricing consistency considerations we have highlighted before. As a result customers perceive rail as a more expensive transport option than LCAs when in fact they are not. Slide 15 makes this point quite clear: while there would be an average price advantage of 28% in favour of rail transport, there is a *perceived disadvantage* of 42%. We yet have no full understanding of the source of the massive misperception of rail prices, but it appears that these misperceptions are a widespread phenomenon. It is interesting to note in this context that other industries such as car rental and hotels have more recently discovered the appeal of aggressive lead prices, presumably for similar reasons.

5. Concluding remarks

We have documented the effect of LCA entry in the German market. We find that this type of inter-modal competition affected railroad origins and destinations (O&Ds) in a substantial

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has been widely applied for problems of regulation, procurement and competition policy, see Laffont and Tirole (1992).

way. After the entry of LCAs, traffic volume of the incumbent rail operator, *Deutsche Bahn*, decreased by up to 50% on relevant O&Ds. The price reactions of DB on one O&D were effective in increasing turnover and stabilizing yield, albeit on a much lower level than before LCA entry. However, compared to airlines, railroads are subject to important constraints that severely limit systemic price reactions such as aggressive, permanent lead prices.

Our case study shows that inter-modal competition has more bite than what is usually considered. This is important for the design of regulatory schemes, for the liberalisation of national railroad markets, and the creation of an integrated European transportation market. In particular, it appears to be misleading to look at regulation of railroad markets in an isolated way, rather than considering the interplay of different modes on a given market. While the market for long-haul passenger traffic in Europe has traditionally been dominated by flag carriers (and to lesser extent, national rail networks), one can expect that it will be heavily contested by LCAs in the future. These LCAs can act and react swiftly. Incumbent airlines also have a rather high degree of flexibility, but owing to their network structure, railroads are much less flexible and hence more vulnerable.

When designing reforms for railroads, regulators should hence take into account that measures that may increase *intra-modal* competition to some extent may, by the same token, weaken rail network operators in the *inter-modal* competition with LCAs and flag carriers.

Finally, to better understand the impact of LCA entry and the reactions to it, it should be noted that the airlines have been affected by deregulation much earlier than railroads. Beginning with 1992, *Lufthansa* has gone through a restructuring program in the course of which the airline was privatized, and a number of activities were spun off. The European airline market was deregulated in 1997, which led to massive changes. Airlines since then hence acquired advanced knowledge about the functioning of a competitive market.

The restructuring process of *Deutsche Bahn* started later (in 1994) and initially took place in a more regulated environment than the airline market. The German market has, however, been opened to other railroad companies, and the domestic long-haul market in Germany is neither regulated nor subsidized. The European market – while still rather strongly regulated - will follow.

The first (mostly partial) reforms that were undertaken already show effects. Friebel et al (2004) show that national restructuring activities and the opening of national markets has had efficiency-enhancing effects on the European rail industry. *Deutsche Bahn* is among the companies that had the largest efficiency gains throughout the last decade. This is also reflected in a massive increase of the financial performance of Deutsche Bahn. DB estimates that the reforms since 1994 have resulted in aggregate cost cutting of more than 100 billion Euros.

These cost-cutting efforts are however necessary, but not sufficient for railroads to be competitive in the *intermodal* market. Rather, intensifying intermodal competition requires new strategies, both reactive and proactive. It requires continuous learning efforts to understand the options and constraints of yield management. As the paper shows, it is possible to react effectively, but it is more difficult for railroads than for airlines.

Finally, given the existence and intensity of *intermodal* competition and the severe network constraints of railroads, most policies that are supposed to increase competition in the *intramodal* market may very well also have effects on the *intermodal* market. Put differently, it will become increasingly important for regulators to think about the definition of the relevant markets when designing reforms.

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Entry of Low Cost Airlines in Germany: Appendix

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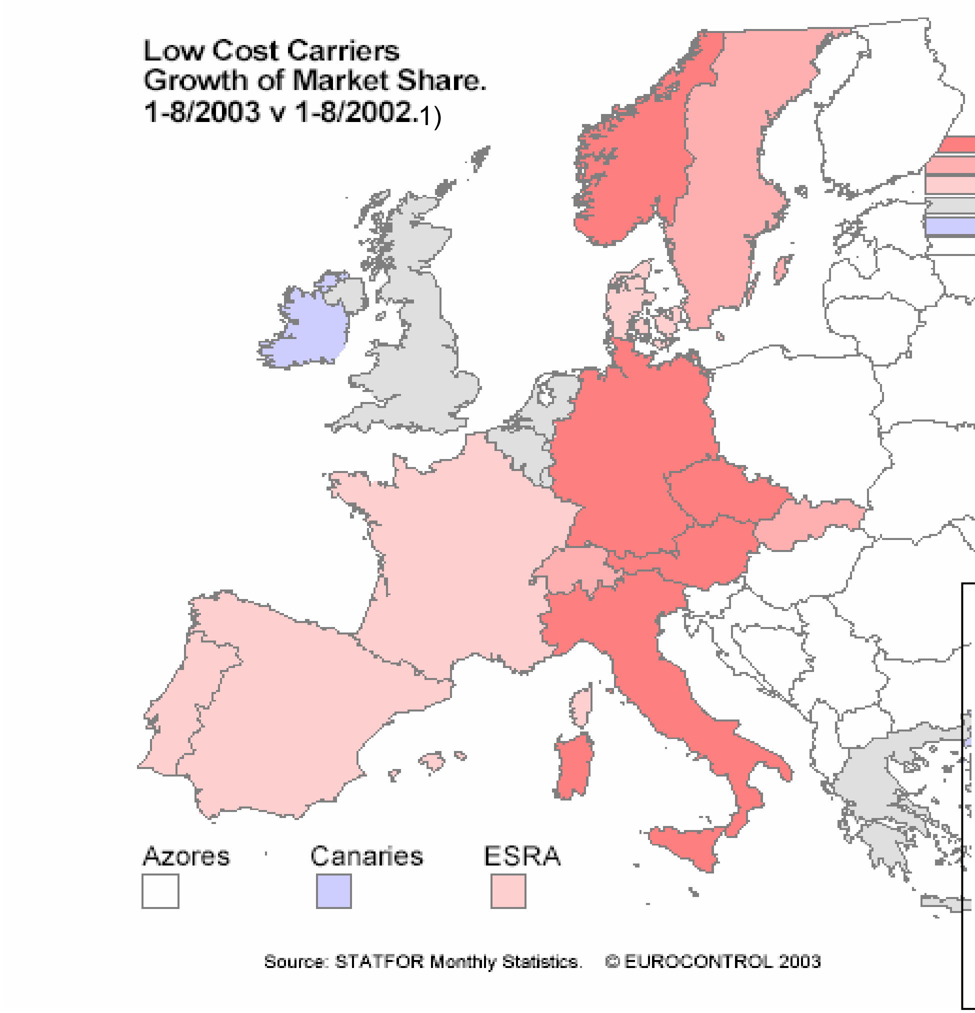
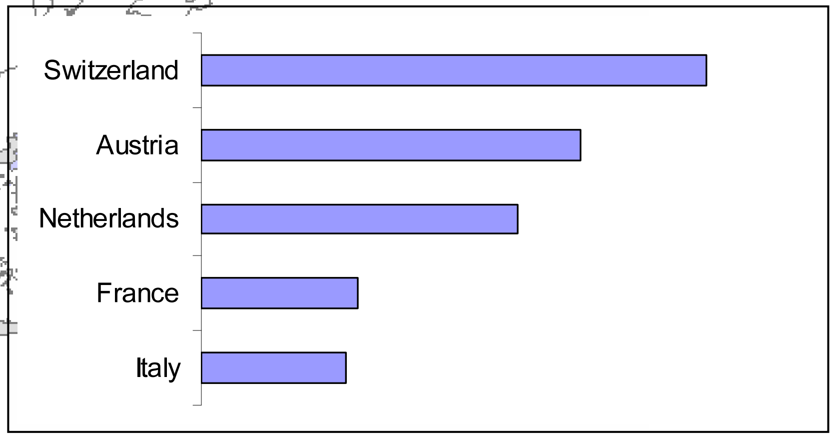
In 2003 Germany experienced some of the strongest LCA-growth in Europe - Important partner countries also with strong growth



Ranking of DB cross-border turnover by country, 2003[2)]



1) http://www.eurocontrol.int/statfor/analysis/43%20Low-cost%20study%20v21.pdf

2) turnover from incoming and outgoing traffic, including night trains

Raising load factors is major challenge for rail - seat-km costs almost 30% below airline competitors‘ levels

Effects of load factor differential on rail cost competitiveness - DB vs. select Airlines

	Cost / available seat-km	Load Factor
Ryanair	0,045	81%
EasyJet	0,071	85%
HLX	0,060	70%
KLM	0,13	78,2%
Lufthansa	0,144	73,1%
DB long-distance	0,051	40%

- On seat-basis rail with clear cost advantage compared to LCA - but LCA with much higher load factors
- Rail needs to raise load factor to lower per-passenger costs

Key Question: How to go about it?

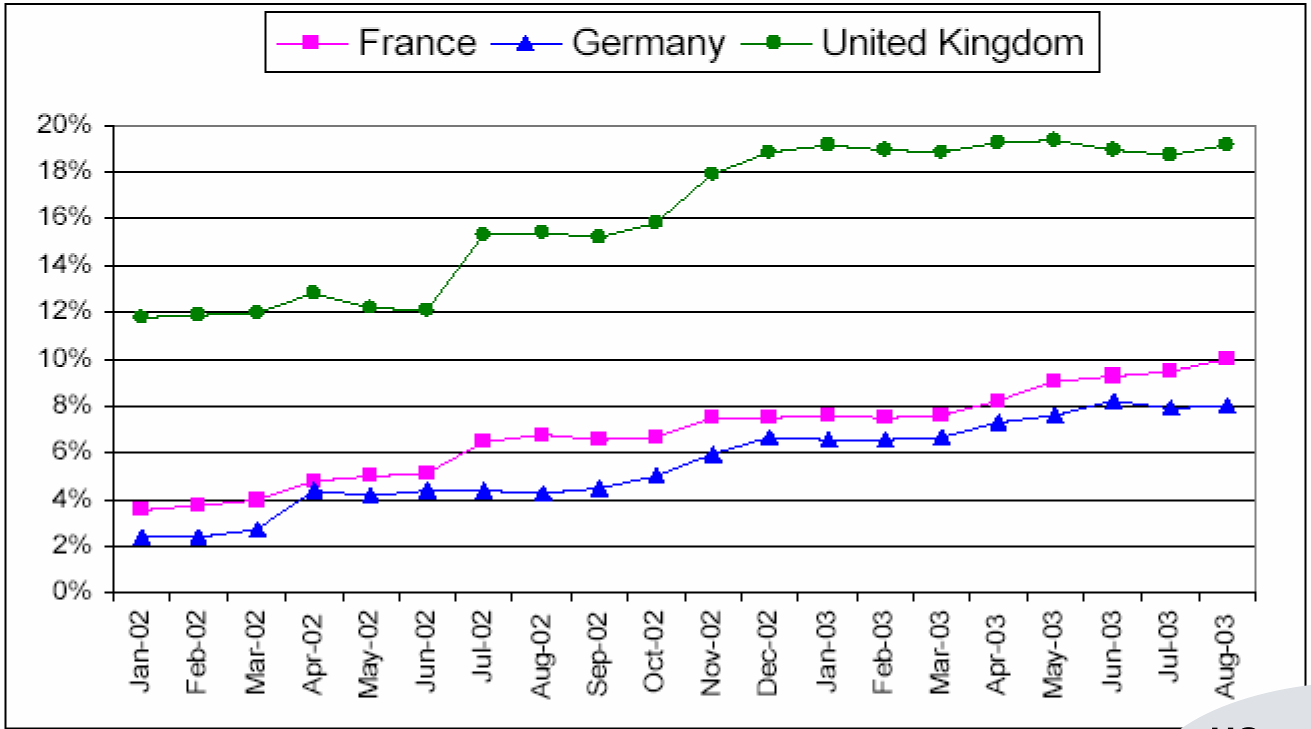
DB compared to EasyJet

28% cost <u>advantage</u> for DB

EasyJet cost data: Urs Binggeli / McKinsey: "Revolutionary or just Specialist - The low-cost concept in Europe" - Presentation at 6th Hamburg Aviation Conference, 13. Feb. 2003 (assumption 1 US$ = 1 €)
Load factor: http://www.easyjet.com/common/img/2004-05-05_interimPresentation.pdf
DB cost data: http://www.db.de/site/shared/de/dateianhaenge/berichte/geschaeftsbericht__2003__fernverkehr.pdf
Load factor: http://www.bahn.de/konzern/holding/umweltschutz/die_bahn_klimaschutzziel.shtml

Strong LCA-growth in Germany in late 2002 - Highest market shares in UK and US

Recent Market Trends - Low-Cost-Airline-Growth



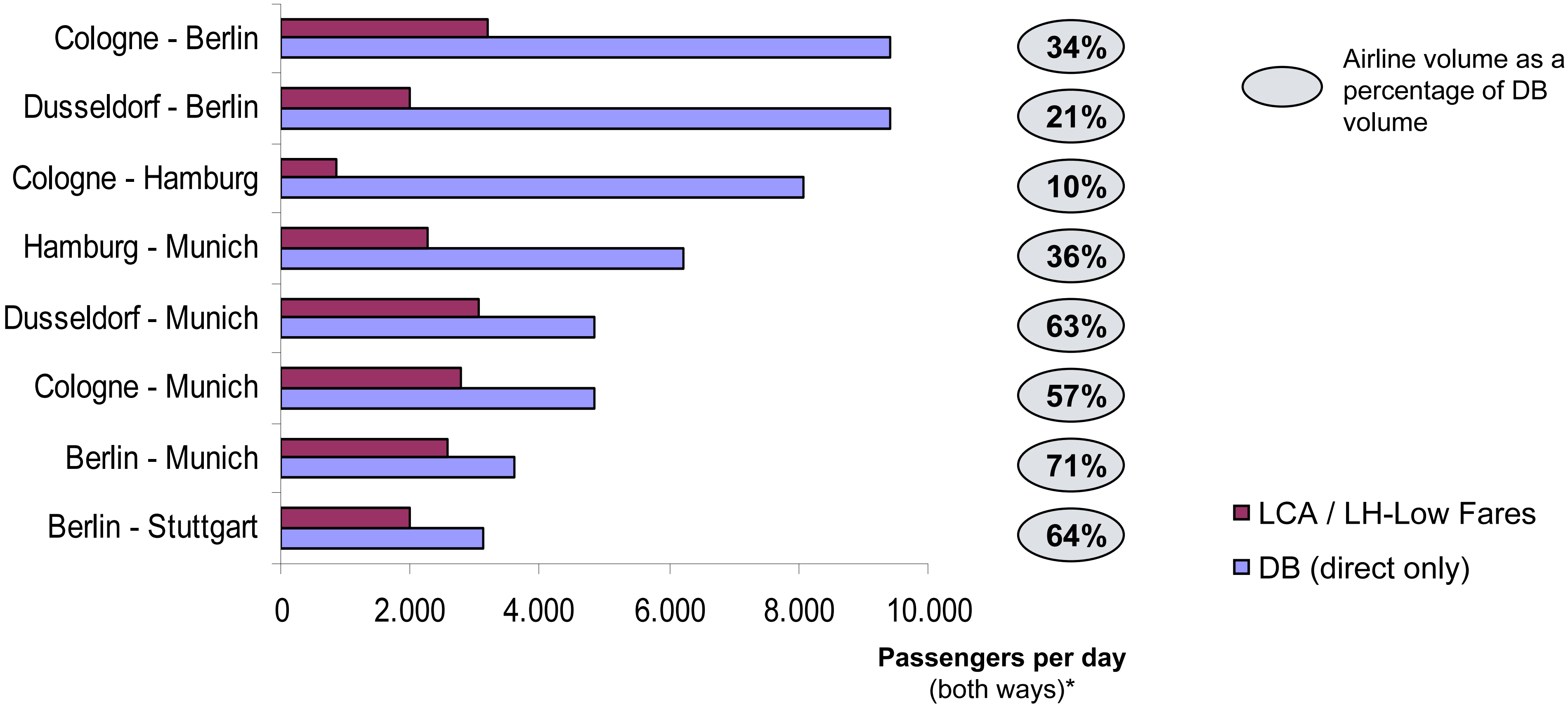
US estimate 2003: up to 25% market share

Source: http://www.eurocontrol.int/statfor/analysis/43%20Low-cost%20study%20v21.pdf;
for US: http://msnbc.msn.com/id/4664730/

On some parts of the DB-network revenue service of low-fare airlines amounts to 70% of DB revenue service

Passengers LCA / LH Low Fares vs. DB

Estimates



* DB: Only direct links (no connections) included in capacity calculation
Assumption for Lufthansa - 25% of tickets in low-fare category; load factor: DB 40%; LCA 80%

Sources: DB: schedule 2003
Airlines: Current Schedules (06/2004)

Market research further supports significant intermodal substitution effects

Substitution rates for selected O&Ds

Route	Direct Substitution* Would have **chosen** rail	 Would have **considered** rail
Domestic (n=1186)	**18,5%**	**33,5%**
Berlin-Cologne (n=429)	**21,2%**	**36,4%**
Berlin-Munich (n=201)	**12,1%**	**25,1%**
Hamburg-Cologne (n=163)	**23,5%**	**38,2%**
Dusseldorf-Berlin (n=133)	**20,1%**	**36,7%**
International (n=986)	**3,9%**	**10,9%**
Airports w/ revenue > € 100.000,- (n=560)	**5,5%**	**14,9%**
to Vienna (n=123)	**5,7%**	**15,5%**
to Zurich (n=104)	**10,9%**	**26,8%**

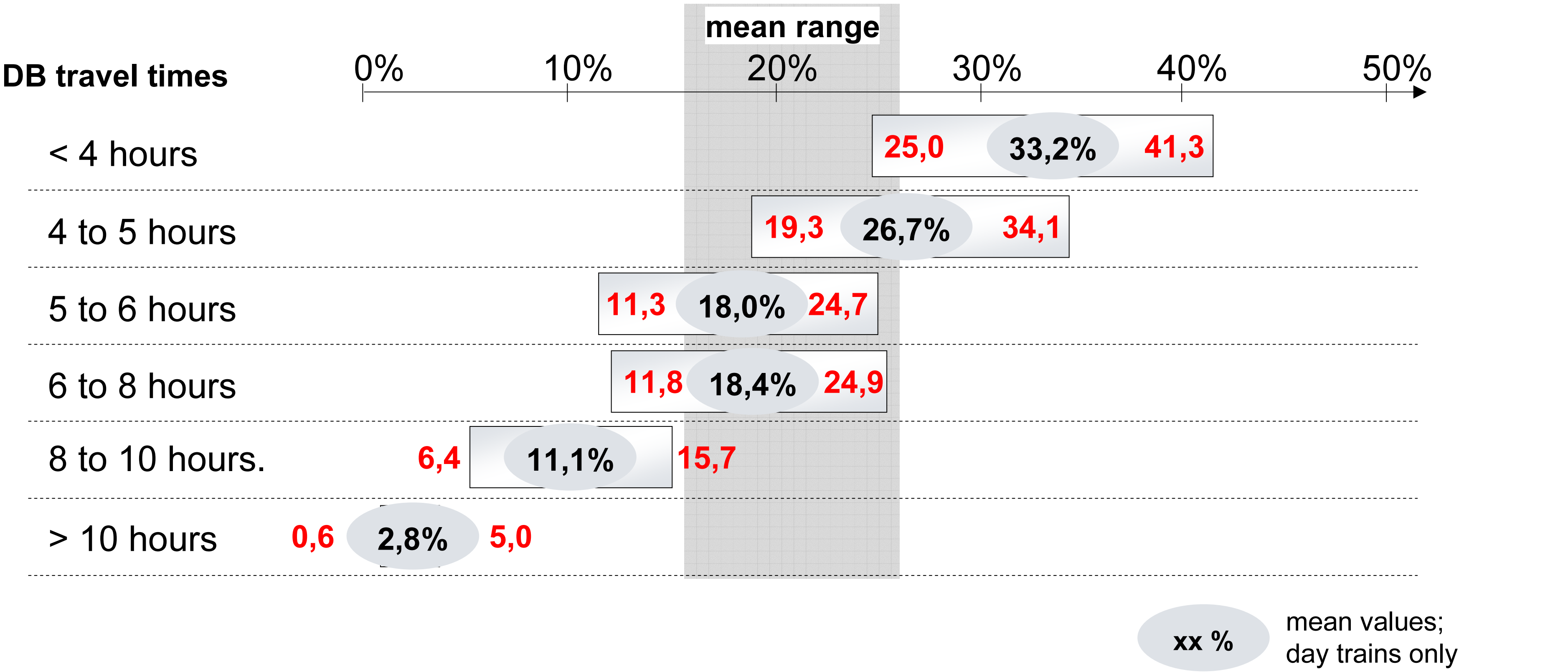
Source: Grunberg et al (07/2003); 2,408 individuals surveyed at six German LCA airports

* day trains only

Market research indicates strong inverse correlation between trip duration and substitution rates

Substitution rates and trip duration

„What proportion of LCA-travellers would have chosen the train instead?"

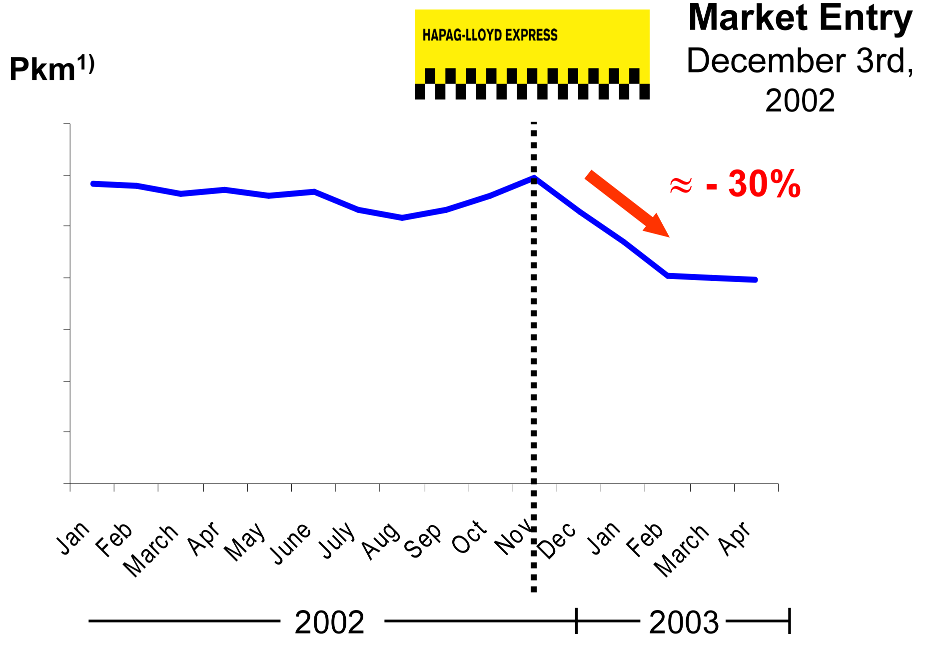


Source: Market research University of Munster (07/2003)

Case studies clearly illustrate effects of low-cost airline entry on rail volume

Effect of LCA entry on DB volume – domestic and international case studies

Cologne - Hamburg



International Destinations

# of Travellers
(01-04/2003 vs. 01-04/2002)

germanwings	**Cologne - Vienna**	**- 56,8%**
AIR-BERLIN We fly Europe	**Hamburg - Vienna**	**- 34,0%**

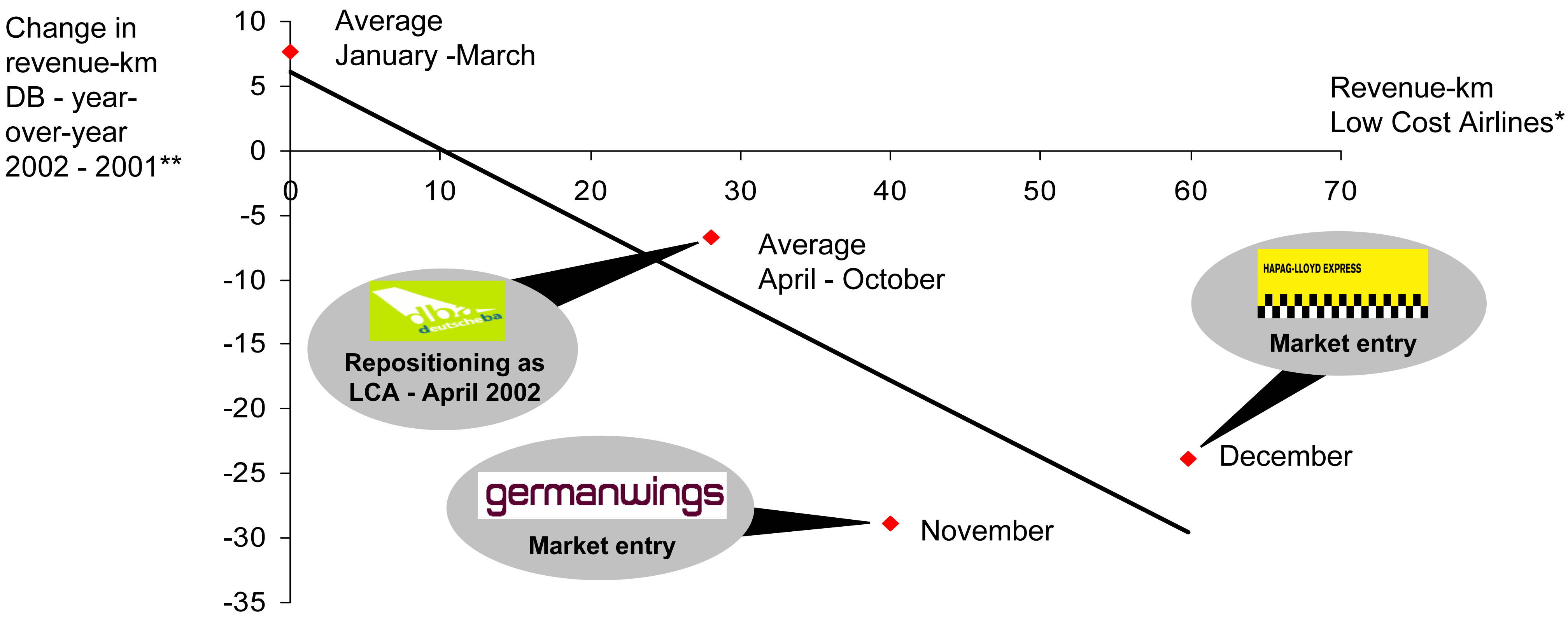
1) 3 months - moving average

Cologne - Berlin also with strong correlation between LCA entry and rail demand decline

Correlation rail vs. LCA revenue-km

COLOGNE - BERLIN

In Mio. revenue-km/month

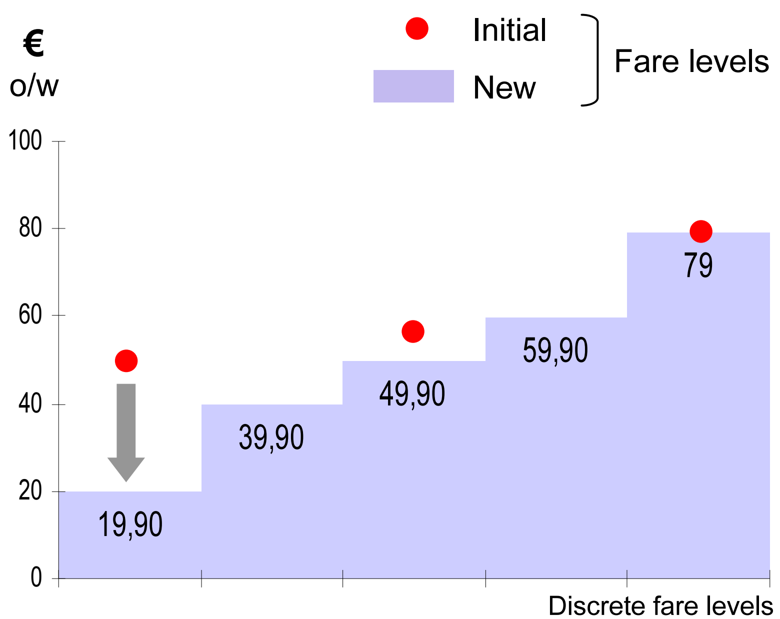


* Calculated based on LCA-seat-km and assumed 80% load factor

In a closed system, DB emulated LCA pricing model - demand rebounded, but yield suffered

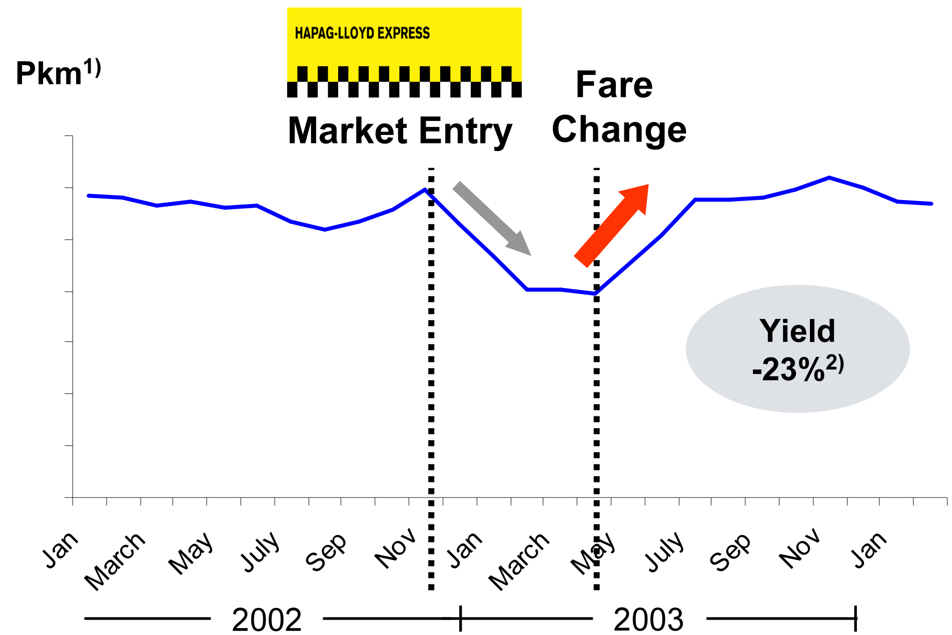
Pricing mechanism and its effects on demand
Cologne - Hamburg

Pricing Approach before and after LCA-entry



Lower price hurdle and **more upselling opportunities** under new appproach

Demand

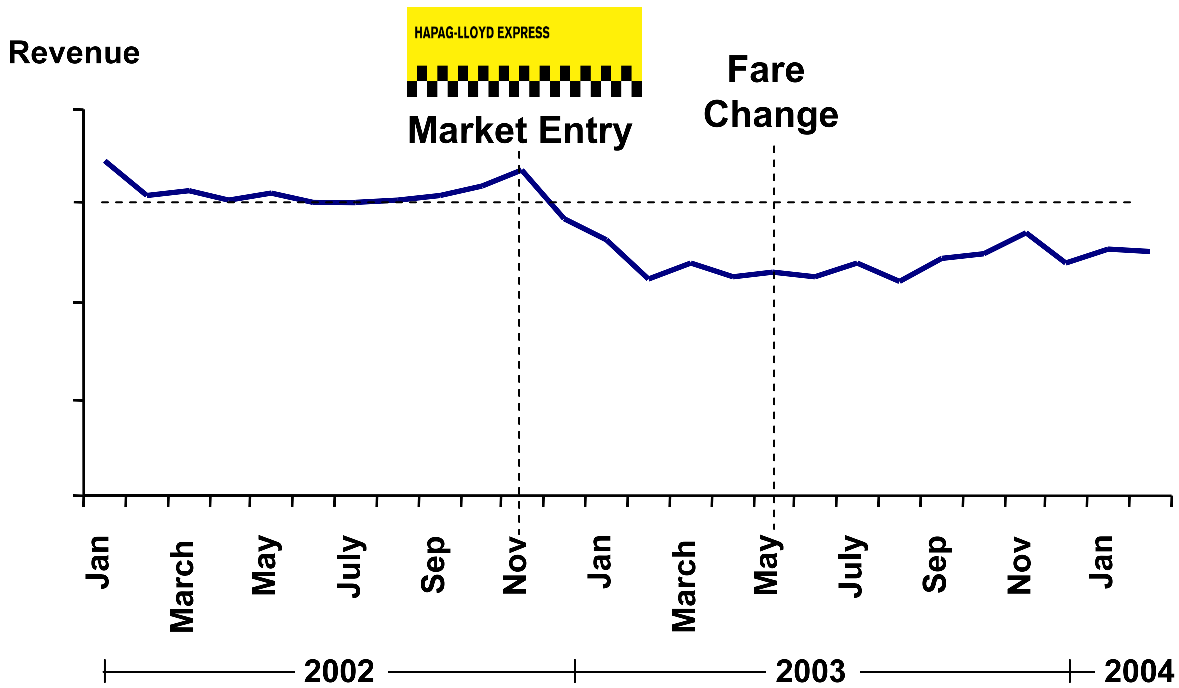


Source: www.met.de - all fares are Traveller Class; BahnCard rebate 25%
Old Pricing: Weekend Special; Return Special (both fares require r/t purchase; Full Fare (all each way)

1) 3 months - moving average
2) 05-2002 - 04/2003 vs. 05/2003 - 02/2004

Effects on revenue mixed - losses stopped but only minor upward trend

Revenue before and after fare change

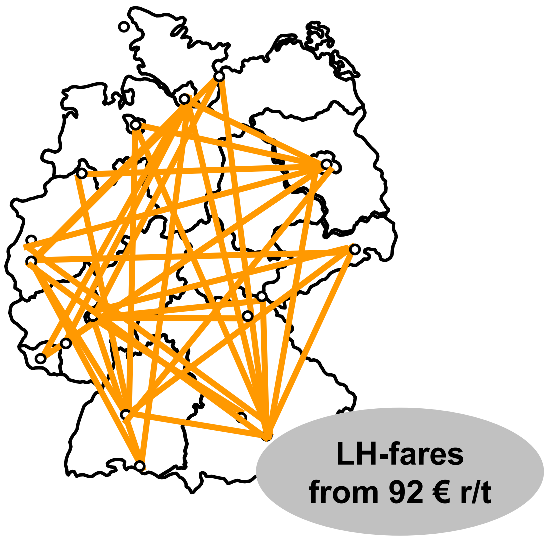


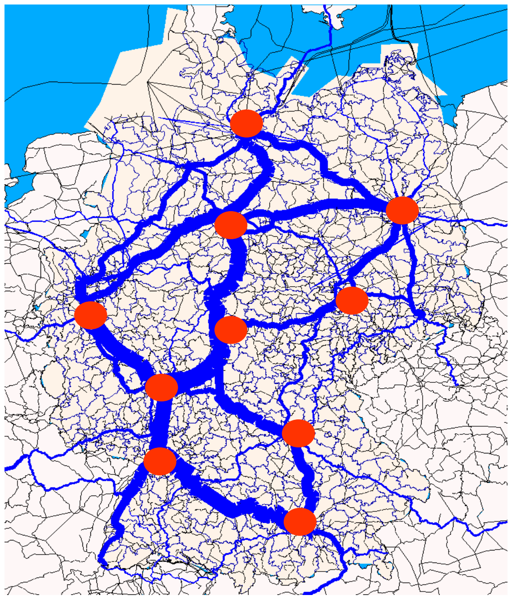
Revenue errosion stopped; slight upward trend apparent

Lufthansa, with a very dense domestic network and low fares, also competes on many of DB core routes

Network Structure Rail, Air

Lufthansa's domestic network	Domestic network of DB





Polycentric network structure - web shape as opposed to star shape

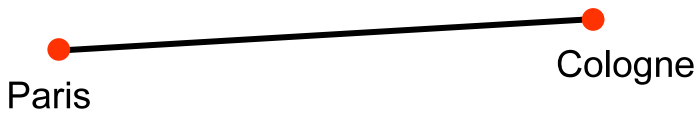
No single focal point due to population distribution

Railways employ Yield Management - But open system nature of rail traffic limits viable pricing options while airlines are more flexible

Constraints of rail network operators - case study

Airline

Example: Germanwings



Lead price: 19 € one-way Paris - Cologne

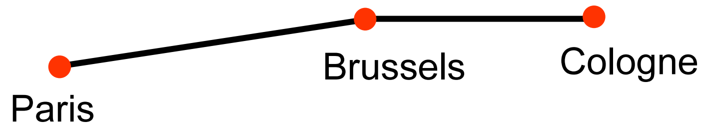
Once aircraft door closes, everyone on board is going to Cologne (completely local traffic Paris - Cologne)

= Closed System

- **Any pricing activity has strictly local effects**
- **Aggressive pricing can be used to attract more passengers and raise load factor**

Railway

Example: Thalys



Assumption:
New lead price 19 € o/w Paris - Cologne

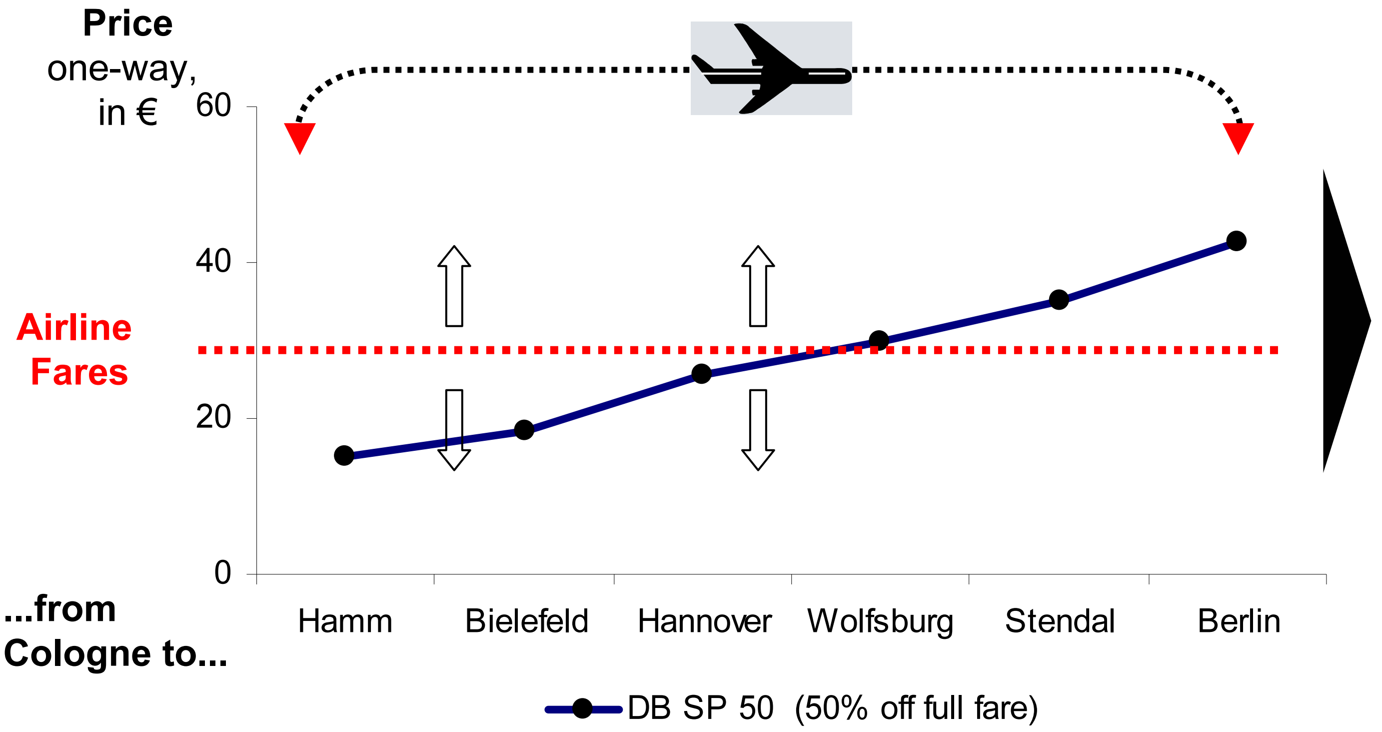
Fare automatically applies to any O&D-on Thalys line - e.g. Paris - Brussels as passengers may board and exit anywhere

= Open System

- **Pricing activities may affect yields on other O&Ds**
- **Unless railways screen customers according to their origin and destinations, there is a price-floor**

In an open system with several intermediate stops aggressive pricing may create inconsistencies

DB - Pricing Cologne - Berlin



Aggressive lead price to compete with LCA may quickly cause **inconsistencies in pricing** - public perception may be negatively affected

e.g. LCA lead price 19 €:

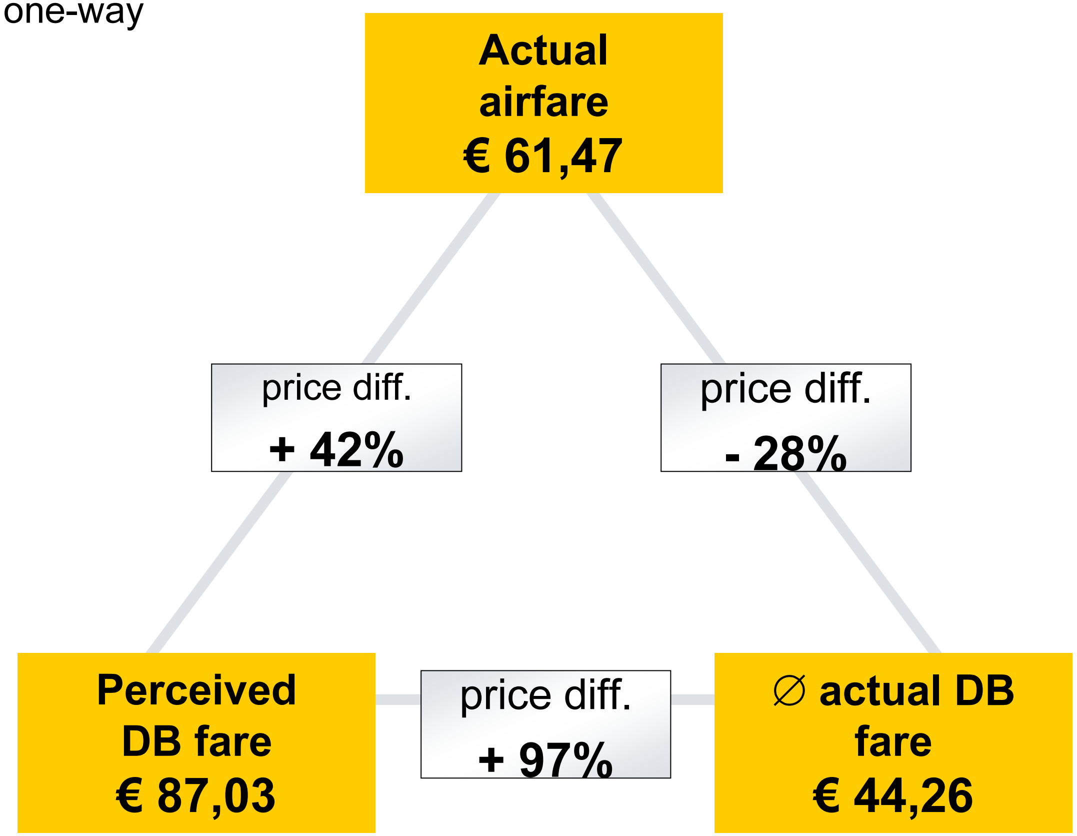
- what price to quote someone going to Hannover?
- how to deal with someone boarding in Hannover?
- how to deal with „sum of locals“- ticketing?

Source: www.bahn.de SP 50: 3-day advance purchase; weekend stay requirement

As railways are unable to match aggressive LCA lead prices, consumers consider rail more expensive

Cologne - Berlin

Fares in € per Person, one-way



Sources: Grunberg et al (07/2003); 2,408 individuals surveyed average DB fare from sales data